Knox Academy
Science Department

S1 Science

Our Material World
Part 2

Write on Booklet

1. Chemical Elements – the Builders

How many materials are there?

There are millions upon millions of different materials, but all are made up from a building set of 'basic bits' that we call elements.

Scientists have identified about **100** elements so far, but more will probably be found.

What are all materials made from?

1. There are approximately _____ elements.

2. There are more m _ _ _ _ _ _ _ _ than e _ _ _ _ _ _ _ because most materials are made up from a combination of elements.

What are elements made from?

1. Elements are made up from a _ _ _ _ .

2. Particles in an element are all the _ _ _ _ .
   Particles in a non element are _ _ _ the same.

3. _____ atoms placed side by side, would fit across one **millimetre**.

What are elements like?

Elements are different from each other in many ways. They can look different or they can behave differently. The way elements look and behave are called **properties**.

The properties of an element scientists often look at first are:

- its appearance
- whether it is a solid, liquid or gas at room temperature (20°C)
- what temperature it boils and melts at
- whether it is a metal or non-metal.

Experiment Results

element	appearance	solid, liquid gas	boiling point	melting point	metal / non - metal

Conclusion: 3 ways in which elements can be different from each other are:

1. _____
2. _____
3. _____

2. The Periodic Table

The Periodic Table shows all the **elements** we know about.
If a material is not an element it will not be on the Periodic table.

Stick your periodic table in here.

Instead of writing the name all the time, each element is given a symbol.

Complete the table on the next page for the first 20 elements. Copy the symbols carefully- sometimes it is a capital letter and sometimes it is a small letter.

Element	Symbol
Hydrogen	H
Helium	He

Use the Periodic Table to find out which of these substances are elements.

water, sulphur, silver, wood, iron, air, carbon, gold.

Circle the substances that are elements.

Stick another Periodic Table in here.

Choose a colour and shade in all the **metals.**
Choose a colour and shade in all the **non metals.**
Choose a colour and shade in all the **gases**
Choose another colour and shade in all the **liquids**

Add a key for each colour used.

1. All metals are _ _ _ solids.

2. All non-metals are _ _ _ solids.

3. How do we get all the other Materials?

New materials are formed when **different** atoms join together.
These new materials are called **compounds**.

Notes: Draw a diagram of a model of an element.

Draw a diagram of a model of a compound.

Complete the following sentences. Add the word element or compound to complete them.

_____ only contain one **kind** of atom.
_____ contain more than one kind of atom.

Do compounds look like the elements they are made from?

Set	Name	Colour	State solid/ liquid/gas	Element or compound
1				
2				

3				
4				

1. Compounds _____ _____ elements from which they are made up?

2. Is it possible to get the names of the elements from which a compound is made by only looking at the **name** of the compound?
   _____

3. What do all the compounds' names have in common?
   _____

4. Making Compounds

Notes:

Magnesium is a _____ metal and oxygen is a _____ gas.

The _____ magnesium and oxygen combine together to make a new _____ called magnesium oxide.

The new compound is a _____ solid and does not _____ like the elements it is made from.

magnesium + oxygen ⟶ magnesium oxide

Making another Compound

Notes:

The iodine solution changed colour from _____ to _____.
This is because the two _____ iodine and zinc have joined together to form the _____ zinc iodide.

zinc + iodine⟶ zinc iodide

Naming Compounds

You have probably noticed that the name of the compounds you have just made end in '**-ide**' . This is usually true for compounds of only two elements. The name of the metal stays the same and the name of the non-metal element changes to '**-ide**' .

e.g oxygen turns to oxide
iodine turns to iodide

Notes: Complete the table.

Element 1	Element 2	Name of Compound
sodium	bromine	
magnesium	chlorine	
silver	oxygen	
aluminium	iodine	
calcium	oxygen	

We can also get the names of elements in a compound by looking at the name of the compound.

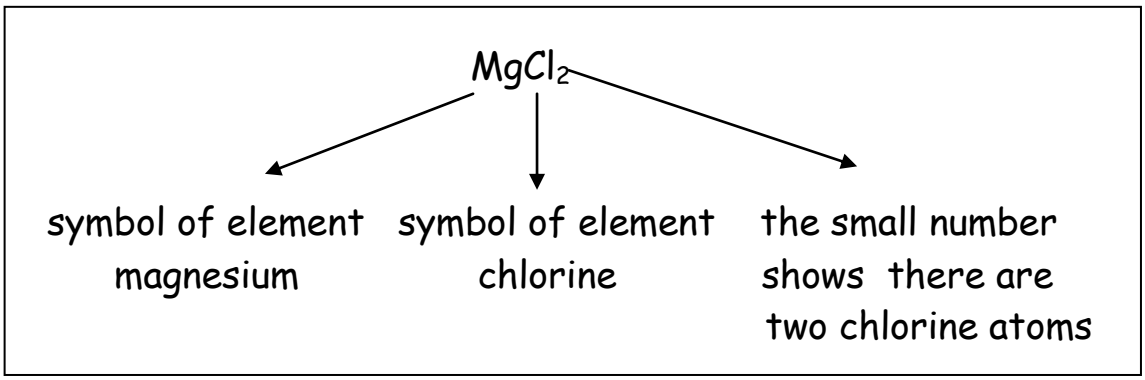
e.g. the compound iron oxide is made up from the elements iron and oxygen.

Notes: Complete the table.

Compound	Metal element	Non-metal element
lead chloride		
copper fluoride		
iron sulphide		
lithium phosphide		

5. Formulae of Compounds

We use symbols to show atoms, such as H for hydrogen or Cl for chlorine. We can also use symbols to show how atoms combine in compounds. When we combine symbols like this, we write a **formula**. Here is the formula for the compound magnesium chloride:



To write a formula you need to know which elements are in the compound, and how many atoms of each.

Compound	No. of Carbon atoms	No. of Hydrogen atoms	No. of Nitrogen atoms	No. of Oxygen Atoms	formula
Water					
Ethane					
Ethanoic acid					
Glycol					
Methane					
methylamine					

Working out formulae for compounds

a	calcium oxide	f	magnesium chloride
b	sodium iodide	g	aluminium chloride
c	sodium oxide	h	aluminium oxide
d	calcium iodide	i	aluminium nitride
e	magnesium oxide	j	magnesium nitride

6. Compounds and Mixtures

Are Compounds and Mixtures the Same?

Notes:

Mixtures and compounds both contain m_ _ _ than one substance.

Atoms in a mixture are _ _ _ joined together.

Atoms in c _ _ _ _ _ _ _ are joined together.

Atoms in a m_ _ _ _ _ _ are easily separated.

Air is a mixture because it contains c _ _ _ _ _ _ _ _ _, e _ _ _ _ _ _ _ _ and a _ _ _ _ not joined together.

.

Try to draw a mind map here linking as many of the words as possible.

7. Solutions

What is a Solution?

Notes: List 4 other solutions you have used at home.

1.

2.

3.

4.

We say a **solid** (or liquid), which forms a **solution** has **dissolved**

Solid	Solid Left Behind?	Clear or Cloudy	Colour?
A			
B			
C			
D			

The solids you have tested which form **clear** mixtures are called **solutions**. It does not matter whether they are **coloured** or **colourless**.

Remember we say a **solid** (or **liquid**), which forms a solution has dissolved.

A substance, which **dissolves** is said to be **soluble** and one which does **not dissolve** is said to be **insoluble**.

Look at your results and complete the sentences.

1. Solid ___ and solid ___were soluble.

2. Solid ___ and solid ___ were insoluble.

   Using the words highlighted on the previous page to complete the following:-

3. When a green solid dissolves the solution formed is c _ _ _ _ and g _ _ _ _.

4. When a white solid dissolves the solution formed is c _ _ _ _ and c _ _ _ _ _ _ _ _ _ _ .

5. When a purple insoluble powder was shaken with water. The mixture formed was c _ _ _ _ _ and p _ _ _ _ _.

8. Speeding up Dissolving

Effect of Stirring

Notes: Draw a diagram of this experiment.

Complete:-

Stirring speeds up/slows down dissolving. (draw a line through the wrong one)

Effect of Particle size

Notes: Draw a diagram of this experiment.

Complete:-

The s _ _ _ _ _ _ the size of the particles the faster they d _ _ _ _ _ _ _ .

Effect of Temperature

Notes: Draw a labelled diagram of the experiment.

Complete:-

The h _ _ _ _ _ the water the f _ _ _ _ _ solid C dissolves.

9. Measuring Solubility

In **Science** we have a special word to describe a substance which is being dissolved. It is called a **solute**. And we have a word to describe the liquid which is doing the dissolving. It called a **solvent**. We could say:-

solute plus **solvent** gives a **solution**

Write in your own words what a solvent is.

Write in your own words what a solute is.

Aim: The aim of this experiment is to compare the solubility of 4 different solids in water.

Notes: Do the experiment on page 26 and fill in the table:

Solid	Tally of Number of Spatulafuls	Total Number of Spatulafuls
Sodium hydrogencarbonate	lll etc.	
Potassium nitrate		
Ammonium nitrate		
Sodium chloride		

Use the information in your table to draw a bar graph here. Remember to finish numbering and label the axes .

Solubility

10 Concentration and Saturated Solutions

Concentration

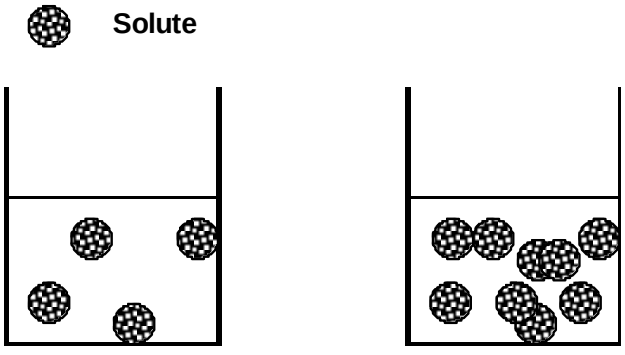
As you now know from the previous lesson you can make up a solution with 1 spatula of salt in 7cm^3 of water. You can also make up a solution with 2 spatulas of salt in the same volume of water.

Do you think both solutions would taste the same?
Do not do this!
The one with 2 spatulas of sodium chloride in the same volume of water would taste saltier and is said to be a stronger solution.

We say the stronger solution is more **concentrated.**
Concentration is a measure of how much solute has been dissolved in a set volume of water (the solvent). We would say the second solution above is twice as concentrated as the first solution because it has twice the number of spatulafuls dissolved in the same volume of water.

Underline the important information in the above paragraphs.

Label one of the diagrams below 'High Concentration' and the other one 'Low Concentration'.



Notes: Complete:-

A saturated solution is one which contains the m _ _ _ _ _ _ quantity of solute which can dissolve at that t _ _ _ _ _ _ _ _ _ _.

Activity: Once you have seen the crystals you have grown complete the following.

If a saturated solution is heated m _ _ _ solute can dissolve. When a hot s _ _ _ _ _ _ _ _ solution is cooled the extra solid comes out of solution and forms c _ _ _ _ _ _ _. All the crystals of a substance have the same basic s _ _ _ _.

11. Alternative Solvents

Notes: List as many examples as you can of household solvents other than water.

Examples:

Dissolving Iodine

Iodine is a shiny black solid which is often used in Science. It would be much more useful if it could be dissolved to form a solution.

Test the solvents you have been given and complete the table:

Iodine Solubility

Solvent	Observation	Soluble/Insoluble

Iodine is soluble in _____ .

Nail Polish

In this experiment we want to find out which solvent best dissolves nail polish.

Do the experiment then write the name of the solvent below which is the best solvent for nail polish.

Solvent:_____

12. Water Cycle

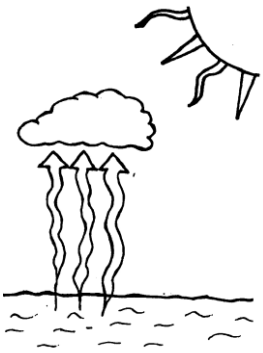
Notes: Earlier this year you learned about changing states. Use this knowledge and the words below to complete activity sheet 12.1.

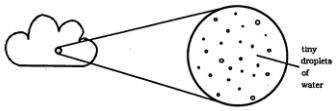
Word Bank:

boil/evaporation, melting, freezing, condensation, liquid water, solid ice, water vapour/steam

Stick in the water cycle diagram here.

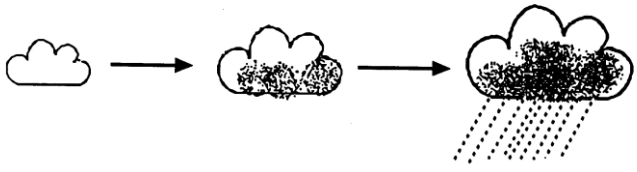
Why do clouds form?





The heat of the sun shining on the sea makes some water evaporate. This water vapour, which is invisible, rises into the air. As it gets higher it also gets colder and at a certain height water vapour starts to condense, forming tiny water droplets. This is how clouds form.

Why does rain fall?



As more and more water evaporates, the clouds get bigger and darker and more filled with water droplets. As this happens the tiny water droplets coalesce (that means join together) to

make bigger droplets. Eventually they are too heavy to stay in the cloud so they fall to the ground as rain.

Why does the sea not empty?

After the rain falls to the ground it forms streams and the streams meet together to form bigger streams and eventually the streams are big enough to be called rivers. Again these rivers join together to form bigger rivers, which flow into the seas or oceans.

Underline the important words in the above paragraphs about clouds, rain and the sea.

The Endless Water Cycle

Notes: Colour in the water cycle sheet above and write the following words in suitable places on the diagram.

Words **Evaporation, condensation, rain falling, stream, river, sea**

13. Separation Techniques

Sieving

Sieving is a good way to separate two different sizes of solids. For example peas from rice. It can also be used to separate large solid particles from water, for example potatoes from the water they were boiled in.

It all depends on the relative sizes of the particles and the sizes in the holes in the sieve.

Notes: Draw a diagram of your experiment from page 35.

Complete:-

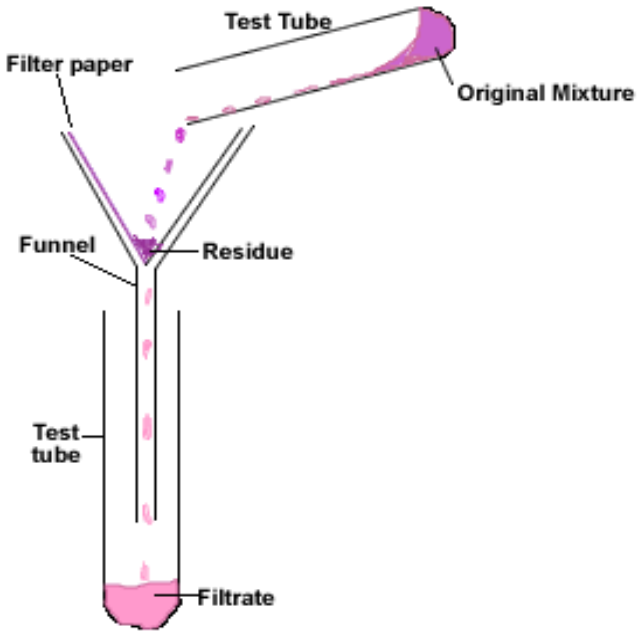
When mixture A was shaken in a s _ _ _ _, the rice passes through the sieve while the peas s _ _ _ in the sieve.
This is because the holes in the sieve are too small to let the p _ _ _ through but big enough to let the r _ _ _ through.

Both flour and salt in mixture B have too small particles to be held in the sieve so can/can not be separated by this method.

Filtering

Filter paper has very small holes in the paper. For this reason it can be used to separate a liquid from a solid, provided the solid particles are not so small that they also go through the holes in the filter paper.

Solids can be separated from liquids by filtration. This is because the holes in the filter paper are small enough not to let the solid material through but large enough to let the liquid through.

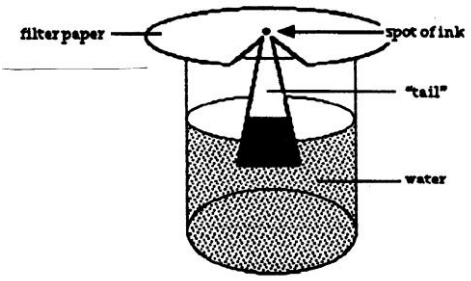


Label the diagram using the words: filtrate, residue, filter paper and filter funnel.

14. Chromatography & Distillation

Chromatography

We have used filtration to separate a solid from a liquid and sieving to separate solids of different size How do we separate two or more liquids mixed together?



One method is **chromatography**.

There are several different ways chromatography can be done. You are going to use paper chromatography, which relies on how strongly the different coloured chemicals stick to the paper. That is, some stick more strongly than others and so are slower to move across the paper. This is particularly useful for separating coloured inks.

Activity: Do the experiment on page 38 and then stick the dried chromatogram onto this page.

Complete: Coloured inks or dyes can be separated using c _ _ _ _ _ _ _ _ _ _ _ _ _ _. This happens because the different d _ _ _ move across the paper at d _ _ _ _ _ _ _ _ speeds.

Distillation

Another way to separate two liquids is to use the technique **distillation.** This method can also be used to separate a soluble solid from a solution of solute and solvent.

Notes: Collect a cut out sheet of the distillation set up and label numbers 1 to 5. Stick this into the space below.

Underline the important words in the information below:

Distillation can be used to separate a mixture of two liquids, which have different boiling points. An example of this is in a whisky distillery, where alcohol is separated from a water and alcohol mixture.
It can also be used to separate a solvent from a mixture of a solvent and dissolved solids. An example of this is in water purification, where pure water can be made from sea water, because dissolved salt makes it undrinkable.